# PHYTOTOXICOLOGY ASSESSMENT SURVEY INVESTIGATION IN THE VICINITY OF SUNCOR, LTD., SARNIA AUGUST 18, 1987

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# PHYTOTOXICOLOGY ASSESSMENT SURVEY INVESTIGATION IN THE VICINITY OF SUNCOR, LTD., SARNIA ON AU[illegible] 18, 1987

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## 1 Introduction

The Alkylation Unit at the Suncor, Sarnia refinery produces a hydrocarbon waste product that contains organic and inorganic fluoride material. The burning of this waste product results in emissions of fluoride to atmosphere. Stack sampling and subsequent modeling had indicated that the half hour point of impingement limit was being exceeded. After meeting with the company a limited vegetation survey was conducted in September of 1986 to determine if fluoride emissions from the company were affecting vegetation. The results of this survey have been reported (Jones, 1986). Elevated levels of fluoride were found at some sites but neither the amount of fluoride nor the pattern of accumulation agreed with the model. The model had predicted higher concentrations over a larger area with the potential for significant injury to sensitive species.

It was determined that a more extensive survey should be carried out in 1987. More stations would be located in the area where the higher concentrations of fluoride were found. The survey would also be conducted earlier in the season so that natural senescence would not interfere with determination of visible fluoride injury.

## 2 Field Observations and Methods

On August 18, 1987 Messrs. R.D. Jones and D.S. Harper of the Phytotoxicology Section, Ministry of Environment conducted a vegetation assessment survey in the immediate vicinity of Suncor Ltd., Sarnia. Bill Hunter of Suncor accompanied the investigators to sites that were accessed through company property.

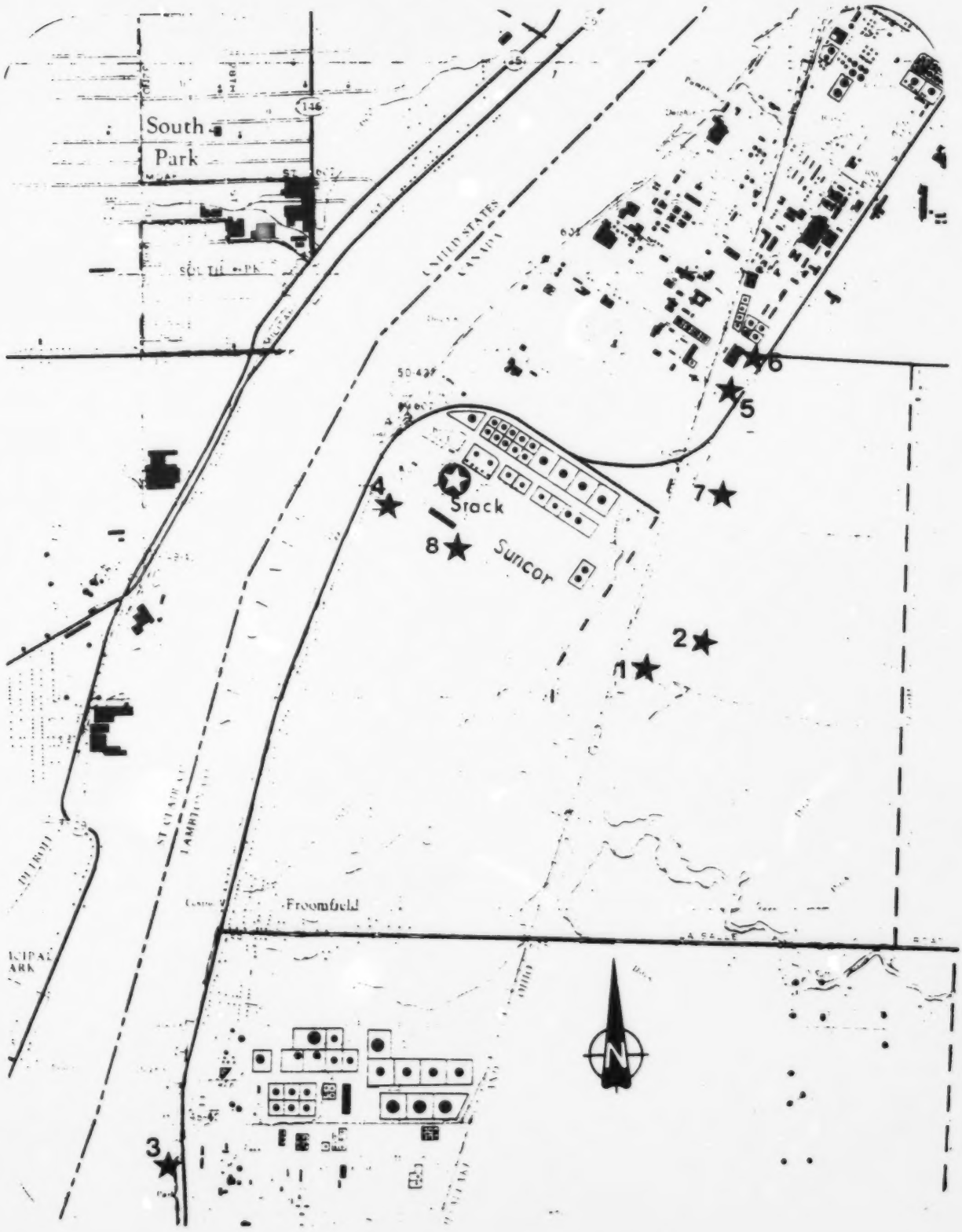
A total of eight sites were sampled within 3.5 km of the stack (see Figure 1). Stations one through five were the same as in the 1986 survey. Station six of the 1986 survey was dropped as it was considered too close to station five to show any difference. Three new stations, seven through nine, were added to help define the area of impact.

Silver maple foliage was collected at stations one to five and red ash was collected at all stations. Duplicate samples were collected and delivered to the Phytotoxicology Section Processing Laboratory where they were dried and ground. The processed samples were submitted to the Inorganic Trace Contaminants Section, Laboratory Services Branch for fluoride analysis.

Visual inspections of fluoride sensitive species, silver maple and wild grape, were conducted at each site if the species were present. No fluoride injury was observed.

**Figure 1: Location of Eight Sampling Locations for Silver Maple and Red Ash Foliage in the Vicinity of Suncor, Sarnia on August 18, 1987**

scale 1:25,000



## 3 Results

The results of the chemical analysis for fluoride are given in Table 1.

**Table 1: Results of the Chemical Analysis of Silver Maple Foliage Collected in the Vicinity of Suncor Ltd., Sarnia on August 18, 1987.**

| Destination Number & Location | Sample Type | Fluoride in ppm dry weight 1986 | 1987 |
|---|---|---|---|
| 1 - 1.25 km, SE | Silver maple | 13 | 8 |
| | Red Ash | NS | <4 |
| 2 - 1.38 km, ESE | Silver maple | 10 | 11 |
| | Red Ash | NS | 6 |
| 4 - 0.33 km, WSW | Silver maple | 84 | 22 |
| | Red Ash | NS | NS |
| 5 - 1.38 km, ENE | Silver maple | 15 | 18 |
| | Red Ash | NS | 22 |
| 7 - 1.35 km, E | Silver maple | NS | NS |
| | Red Ash | NS | 44 |
| 8 - 0.37 km, SSE | Silver maple | NS | NS |
| | Red Ash | NS | 33 |
| 3 - 3.5 km, SSW (Control) | Silver maple | 6 | 12 |
| | Red Ash | NS | 8 |
| Upper Limits of Normal Urban Concentration | | 35 | 35 |
| NS - no sample | | | |

The data from the 1987 survey indicate that there is a pattern of low level accumulation of fluoride in vegetation around the Suncor refinery. The level of fluoride in tree foliage appears to be between 22 to 44 ppm in the area immediately around the stack and extending approximately 1.5 km to the east and north east of the stack. This pattern would tend to agree with the wind patterns for the summer months. The level of fluoride found in this area are approximately 2 to 4 times that found in the control area.

The levels at station four are significantly lower than the 1986 results. Stations one to three and five are generally the same for both years, within analytical and sampling errors. Only at the new stations seven do the levels exceed the Upper Limit of Normal Concentration for fluoride in tree foliage.

The concentration of fluoride found in the tree foliage is below the level that would cause injury to moderately sensitive species such as silver maple. The lack of any observable injury to silver maple and wild grape would support this.

## 4 Summary

The burning of waste products from the Suncor Alkylation Unit is causing slightly elevated levels of fluoride in vegetation within 1.5 km of the unit. The levels exceeded the Urban Upper Limit of Normal at two locations (one each year) but were not high enough to cause injury to moderately sensitive vegetation in the area.

Because of the difference between the 1986 and 1987 surveys that it is difficult to determine the full impact of the fluoride emissions from Suncor. Therefore, the survey will be continued for at least two more years.

# 5 Appendix

## 5.1 Bibliography

1. Jones, R.D., 1986, A Report on a Phytotoxicology Section Investigation in the Vicinity of Suncor, Sarnia on September 17, 1986., ARB No. - 217 - 86 - Phyto.

## 5.2 Upper Limits of Normal

### Derivation and Significance of M.O.E. "Upper Limits of Normal" Contaminant Guidelines

The MOE "upper limits of normal" contaminant guidelines essentially represent the expected maximum concentration of contaminants in surface soil (non-agricultural), foliage (tree and shrub), grass, moss bags and/or snow from areas of Ontario not subject to the influence of point sources of emissions. "Urban" guidelines are based upon samples collected from centers of minimum 10,000 population. "Rural" guidelines are based upon samples collected from non-built-up areas. Samples were collected by MOE personnel using standard sampling techniques (ref: Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch: Technical Support Sections - NE and NW Regions). Chemical analyses were performed by the MOE Laboratory Services Branch.

The guidelines were calculated by taking the arithmetic mean of available analytical data and adding three standard deviations of the mean. For those distributions that are "normal", 99% of all contaminant levels in samples from "background" locations (i.e. not affected by point sources nor agricultural activities) will lie below these upper limits of normal. For those distributions that are non-normal, the calculated upper limits of normal will not actually equal the 99th percentile, but nevertheless they lie within the observed upper range of MOE results for Ontario samples.

Due to the large variability in element concentrations which may be present across Ontario, even in background data, control samples should always be collected. This is particularly important for soils, which may show large regional variations in element composition due to difference in parent material. Species of vegetation which naturally accumulate high levels of an element also may be encountered.

It is stressed that these guidelines do not represent maximum desirable or allowable levels of contaminants. Rather, they serve as levels which, if exceeded, would prompt further investigation on a case by case basis to determine the significance, if any, of the above normal concentration(s). Concentrations which exceed the guidelines are not necessarily toxic to plants, animals or man. Concentrations which are below the guidelines are not known to be toxic.